competition increases in all areas of telecommunications. Yet the Bill and Keep proposal will cause a failure of productive efficiency which leads to the largest losses in economic efficiency of almost any proposal I can analyze.

63. Bill and Keep, even as an interim plan, will create the wrong incentives for market participants. PCS providers will have no incentive to minimize their costs; instead, they will attempt to cause the LECs to provide additional free services. The LECs will not have an incentive to offer choices, but instead, they will also attempt to minimize their costs causing the PCS providers to expend more resources. Also, Bill and Keep will lead to misguided investment by firms which will create long lasting distortions to the economy. Network investment by PCS providers will take Bill and Keep into account as will network investment by LECs who will be forced to expand to meet unpriced peak load capacity increases. Since these investments are sunk costs with an absence of rapid growth in other LEC network services, the distortions are likely to remain for a considerable period of time, even after Bill and Keep has been eliminated in favor of a more rational economic pricing framework. These long lasting economic distortions cause losses in economic efficiency.

64. A much better idea than adopting a deeply flawed interim policy is to put into place the correct economic principle now--firms pay for cost that they cause.[20] This principle is honored throughout the U.S. market economy, and I see no reason why it does not work in the current situation. The Commission could adopt this policy and allow it to become effective when current interconnection contracts expire (e.g. Spring 1997 for Pacific Bell). Bill and Keep is not the correct place to begin since it has a zero charge for interconnection which is not near the correct answer.

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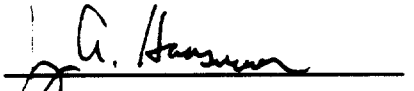
[20] "Now" is figurative, because any change in current interconnection arrangements, including introduction of Bill and Keep, will require implementation time.

65. Lastly, if Bill and Keep is instituted as an interim policy, it will be difficult to remove because of regulatory incentives to fight its removal. I need hardly cite cases of subsidies for mohair, peanuts, and well off telephone subscribers which have been extremely difficult to eliminate despite a wide consensus that the subsidies no longer serve a rational economic purpose. Closer to home, enhanced service providers (ESPs) received a waiver on access charges at divestiture (1983) which is still in place 13 years after it was introduced, despite attempts to remove it at different times. Internet service providers have used this exemption to provide service over 1MB lines and do not typically pay for costs created by their network usage. Regulatory lawyers will have a field day inventing yet even more new reasons why the misguided regulatory policy of Bill and Keep should be continued. The regulatory debate could take years while telecommunications technology and economics changes even faster and telecommunications policy is unable to keep up with the changes.

66. The Commission should recognize Bill and Keep for what it really is--a request for a free lunch at the expense of the LECs. While Congress and President Clinton have recognized that the era of "big government" handouts is over, the Commission has tentatively decided to cause the LECs to subsidize PCS (and perhaps other CMRS providers) with free interconnection. The recent telecommunications legislation establishes a framework where competition, not subsidies, will be the basis for telecommunications policy. The Commission should not establish a new subsidy framework for PCS and CMRS providers at the very beginning of a new competitive era of telecommunications in the U.S.

February 29, 1996



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November 1995

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EDUCATION:

OXFORD UNIVERSITY
D. Phil. 1973 (Ph.D)
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BROWN UNIVERSITY
A.B. (Summa Cum Laude), 1968

THESIS: "A Theoretical and Empirical Study of Vintage Investment and Production in Great Britain," Oxford University, 1973.

FELLOWSHIPS, HONORS AND AWARDS:

Phi Beta Kappa
Marshall Scholar at Oxford, 1970-1972
Scholarship at Nuffield College, Oxford, 1971-1972
Fellow of Econometric Society, 1979.
Frisch Medal of the Econometric Society, 1980
Fisher-Schultz Lecture for the Econometric Society, 1982
John Bates Clark Award of the American Economic Association, 1985
Jacob Marschak Lecture for the Econometric Society, 1988
American Academy of Arts and Sciences, 1991.

EMPLOYMENT:

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

1992-	John and Jennie S. MacDonald Professor
1979-	Professor, Department of Economics
1976-79	Associate Professor, Department of Economics
1973-76	Assistant Professor, Department of Economics
1972-73	Visiting Scholar, Department of Economics

VISITING APPOINTMENTS:

1986-87	Visiting Professor, Harvard Business School
1982-83	Visiting Professor, Harvard University Department of Economics

U.S. ARMY, ANCHORAGE, ALASKA

1968-70	Corps of Engineers

PROFESSIONAL ACTIVITIES:

Associate Editor, Bell Journal of Economics, 1974-1983
Associate Editor, Rand Journal of Economics, 1984-1988
Associate Editor, Econometrica, 1978-1987
Reviewer, Mathematical Reviews, 1978-1980
American Editor, Review of Economic Studies, 1979-82
Associate Editor, Journal of Public Economics, 1982-
Associate Editor, Journal of Applied Econometrics, 1985-1993
Member of MIT Center for Energy and Environmental Policy Research, 1973-
Research Associate, National Bureau of Economic Research, 1979-
Member, American Statistical Association Committee on Energy Statistics, 1981-1984
Special Witness (Master) for the Honorable John R. Bartels, U.S. District Court for the Eastern District of New York in Carter vs. Newsday, Inc., 1981-82
Member of Governor's Advisory Council (Massachusetts) for Revenue and Taxation, 1984-1992
Member, Committee on National Statistics, 1985-1990
Member, National Academy of Social Insurance, 1990-
Member, Committee to Revise U.S. Trade Statistics 1990-1992
Director, MIT Telecommunications Economics Research Program, 1988-
Board of Directors, Theseus Institute, France Telecom University, 1988-
Member, Conference on Income and Wealth, National Bureau of Economic Research, 1992-

PUBLICATIONS:

I. Econometrics

"Minimum Mean Square Estimators and Robust Regression," Oxford Bulletin of Statistics, April 1974.

"Minimum Distance and Maximum Likelihood Estimation of Structural Models in Econometrics," delivered at the European Econometric Congress, Grenoble: August 1974.

"Full-Information Instrumental Variable Estimation of Simultaneous Equation Models," Annals of Economic and Social Measurement, October 1974.

"Estimation and Inference in Nonlinear Structural Models," Annals of Economic and Social Measurement, with E. Berndt, R.E. Hall, and B.H. Hall, October 1974.

"An Instrumental Variable Approach to Full-Information Estimators in Linear and Certain Nonlinear Econometric Models," Econometrica, May 1975.

"Simultaneous Equations with Errors in Variables," delivered at Winter Econometric Meetings, San Francisco: December 1974; published in Journal of Econometrics 5, 1977, pp. 389-401.

"Social Experimentation, Truncated Distributions, and Efficient Estimation," delivered at the World Econometric Congress, Toronto: August 1975; Econometrica, with D. Wise, June 1977.

"A Conditional Probit Model for Qualitative Choice," delivered at World Econometric Congress, Toronto: August 1975; MIT Working Paper 173, April 1976; Econometrica, with D. Wise, March 1978.

PUBLICATIONS cont.:

"Specification Tests in Econometrics," MIT Working Paper 185, June 1976; Econometrica, 1978.

"Non-Random Missing Data," with A.M. Spence, MIT Working Paper 200, May 1977.

"Attrition Bias in Experimental and Panel Data: The Gary Income Maintenance Experiment," with D. Wise, J.F. Kennedy School Working Paper, May 1977; Econometrica, January 1979.

"Missing Data and Self Selection in Large Panels," with Z. Griliches and B.H. Hall, Harvard Economics Department Working Paper, August 1977; delivered at INSEE conference on Panel Data, Paris: August 1977; Annales de l'INSEE, April 1978.

"Stratification on Endogenous Variables and Estimation," with D. Wise, J.F. Kennedy School Working Paper, January 1978; delivered at CME Conference, April 1978; in The Analysis of Discrete Economic Data, ed. C. Manski and D. McFadden, MIT Press, 1981.

"Les models probit de choix qualitatifs," ("Alternative Conditional Probit Specifications for qualitative Choice.") (English Version), September 1977; EPRI report on discrete choice models, presented at INSEE Seminar, Paris: May 1978; Cahiers du Seminar d'Econometrie, 1980.

"The Econometrics of Labor Supply on Convex Budget Sets," Economic Letters, 1979.

"Panel Data and Unobservable Individual Effects," with W. Taylor, MIT Working Paper 225; Econometrica 49, November 1981.

"Comparing Specification Tests and Classical Tests," with W. Taylor, August 1980, Economic Letters, 1981.

"The Effect of Time on Economic Experiments," invited paper at Fifth World Econometrics Conference, August 1980; in Advances in Econometrics, ed. W. Hildebrand, Cambridge University Press, 1982.

"Sample Design Considerations for the Vermont TOD Use Survey," with John Trimble, Journal of Public Use Data, 9, 1981.

"Identification in Simultaneous Equations Systems with Covariance Restrictions: An Instrumental Variable Interpretation," with W. Taylor, December 1980; Econometrica, 1983.

"Stochastic Problems in the Simulation of Labor Supply," presented at NBER conference, January 1981; in Tax Simulation Models, ed. M. Feldstein, University of Chicago Press, 1983.

"The Design and Analysis of Social and Economic Experiments," invited paper for 43rd International Statistical Institute Meeting, 1981; Review of the ISI.

"Specification and Estimation of Simultaneous Equation Models," in Handbook of Econometrics, ed. Z. Griliches and M. Intriligator, vol. 1, 1983.

"Full-Information Estimators," in Kotz-Johnson, Encyclopedia of Statistical Science,vol. 3, 1983

"Instrumental Variable Estimation," in Kotz-Johnson, Encyclopedia of Statistical Science, vol. 4, 1984

PUBLICATIONS cont.:

"Specification Tests for the Multinomial Logit Model," with D. McFadden, October 1981; Econometrica, 1984.

"Econometric Models for Count Data with an Application to the Patents R&D Relationship," with Z. Griliches and B. Hall, NBER Working Paper, August 1981; Econometrica, 1984.

"The Econometrics of Nonlinear Budget Sets," Fisher-Shultz lecture for the Econometric Society, Dublin: 1982; Econometrica, 1985.

"The J-Test as a Hausman Specification Test," with H. Pesaran, November 1982; Economic Letters, 1983.

"Seasonal Adjustment with Measurement Error Present," with M. Watson, May 1983; Journal of the American Statistical Association, 1985.

"Efficient Estimation and Identification of Simultaneous Equation Models with Covariance Restrictions," with W. Newey and W. Taylor, October 1983; Econometrica, 1987.

"Technical Problems in Social Experimentation: Cost Versus Ease of Analysis," with D. Wise, in Social Experimentation, ed. J. Hausman and D. Wise, 1985.

"Errors in Variables in Panel Data," with Z. Griliches, Journal of Econometrics, 1986.

"Specifying and Testing Econometric Models for Rank-Ordered Data," with P. Ruud; Journal of Econometrics, 1987.

"Semiparametric Identification and Estimation of Polynomial Errors in Variables Models," with W. Newey, J. Powell and H. Ichimura, 1986, Journal of Econometrics, 1991.

"Flexible Parametric Estimation of Duration and Competing Risk Models," with A. Han, November 1986, revised January 1989, Journal of Applied Econometrics, 1990.

"Consistent Estimation of Nonlinear Errors in Variables Models with Few Measurements," with W. Newey and J. Powell, 1987.

"Optimal Revision and Seasonal Adjustment of Updated Data: Application to Housing Starts," with M. Watson, Journal of the American Statistical Association Proceedings, 1991.

"Seasonal Adjustment of Trade Data," with R. Judson and M. Watson, ed. R. Baldwin, Behind the Numbers: U.S. Trade in the World Economy, 1992.

"Nonparametric Estimation of Exact Consumers Surplus and Deadweight Loss," with W. Newey, 1992, Econometrica, 1995.

"Misclassification of a Dependent Variable in Qualitative Response Models," with F. Scott-Morton, mimeo December 1993.

"Nonlinear Errors in Variables: Estimation of Some Engel Curves," Jacob Marschak Lecture of the Econometric Society, Canberra 1988, Journal of Econometrics, 65, 1995.

PUBLICATIONS cont.:

II. Public Finance

"The Evaluation of Results from Truncated Samples," with D. Wise, Annals of Economic and Social Measurement, April 1976.

"Discontinuous Budget Constraints and Estimation: The Demand for Housing," with D. Wise, J.F. Kennedy School Working Paper, July 1977; Review of Economic Studies, 1980.

"The Effect of Taxation on Labor Supply: Evaluating the Gary Negative Income Tax Experiment," with G. Burtless, October 1977; Journal of Political Economy, December 1978.

"AFDC Participation -- Permanent or Transitory?," delivered at NBER-NSF Conference, August 1978; in Papers from the European Econometrics Meetings, ed. E. Charatsis, North Holland: 1981.

"The Effect of Wages, Taxes, and Fixed Costs on Women's Labor Force Participation," March 1979; presented at SSRC-NBER Conference on Taxation, Cambridge, England: June 1979; Journal of Public Economics, October 1980.

"The Effect of Taxes on Labor Supply," presented at Brookings Conference, October 1979; published in How Taxes Affect Economic Behavior, ed. H. Aaron and J. Pechman, Brookings: 1981.

"Income and Payroll Tax Policy and Labor Supply," presented at St. Louis Fed. conference, October 1980; in The Supply Side Effects of Economic Policy, ed. G. Burtless, St. Louis: 1981.

"Individual Retirement Decisions Under an Employer-Provided Pension Plan and Social Security," with G. Burtless, Journal of Public Economics, 1982.

"Individual Retirement and Savings Decisions," with P. Diamond, October 1981; presented at SSRC-NBER Conference on Public Economics, Oxford: June 1982; Journal of Public Economics, 1984.

"Retirement and Unemployment Behavior of Older Men," with P. Diamond, presented at Brookings Conference on the Aged, November 1982; in H. Aaron and G. Burtless, Retirement and Economic Behavior, Brookings: 1984.

"Tax Policy and Unemployment Insurance Effects on Labor Supply," May 1983; in Removing Obstacles to Economic Growth, ed. M. Wachter, 1984.

"Family Labor Supply with Taxes," with P. Ruud, American Economic Review, 1984.

"Social Security, Health Status and Retirement," with D. Wise, in Pensions, Labor, and Individual Choice, ed. D. Wise, 1985.

"The Effect of Taxes on Labor Supply," January 1983; in Handbook on Public Economics, ed. A. Auerbach and M. Feldstein, 1985.

"Choice Under Uncertainty: The Decision to Apply for Disability Insurance," with J. Halpern, Journal of Public Economics, 1986.

PUBLICATIONS cont.:

"Household Behavior and the Tax Reform Act of 1986," with J. Poterba, October 1986; Journal of Economic Perspectives, 1987, also published in French in Annales D'Economie et de Statistique, 1988.

"Involuntary Early Retirement and Consumption," with L. Paquette, ed. G. Burtless, Economics of Health and Aging, 1987.

"Income Taxation and Social Insurance in China," in Sino-U.S. Scholars on Hot Issues in China's Economy, 1990.

"On Contingent Valuation Measurement of Nonuse Values," with P. Diamond, in Contingent Valuation: A Critical Appraisal, ed. J. Hausman, 1993.

"Does Contingent Valuation Measure Preferences? Experimental Evidence," with P. Diamond, G. Leonard, M. Denning, in Contingent Valuation: A Critical Appraisal, ed. J. Hausman, 1993.

"Contingent Valuation: Is Some Number Better than No Number?" with P. Diamond, December 1993, Journal of Economic Perspectives, 8, 1994.

"A Utility-Consistent Combined Discrete Choice and Count Data Model: Assessing Recreational Use Losses Due to Natural Resource Damage," with G. Leonard and D. McFadden, October 1992, Journal of Public Economics, 56, 1995.

"The Cost of Cellular Telephone Regulation," mimeo, 1995.

"Contingent Valuation Measurement of Nonuse Values," with P. Diamond, ed. R.B. Stewart, Natural Resource Damages: A Legal, Economic, and Policy Analysis, 1995.

III. Applied Micro Models

"Project Independence Report: A Review of U.S. Energy Needs up to 1985," Bell Journal of Economics, Autumn 1975.

"Individual Discount Rates and the Purchase and Utilization of Energy Using Durables," MIT Energy Laboratory Working Paper, January 1978; Bell Journal of Economics, Spring 1979.

"Voluntary Participation in the Arizona Time of Day Electricity Experiment," with D. Aigner, May 1978; delivered at EPRI Conference on Time of Day Pricing, June 1978; in EPRI Report, Modeling and Analysis of Electricity Demand by Time of Day, 1979; Bell Journal of Economics, 1980.

"A Two-level Electricity Demand Model: Evaluation of the Connecticut Time-of-Day Pricing Test," delivered at EPRI Conference on Time of Day Pricing; with D. McFadden, in EPRI Report, Modeling and Analysis of Electricity Demand by Time of Day, 1979; Journal of Econometrics, 1979.

"Assessing the Potential Demand for Electric Cars," with S. Beggs and S. Cardell, presented at EPRI Conference, November 1979; Journal of Econometrics, 1981.

"Assessment and Validation of Energy Models," presented at EIA-NBS conference on Energy Models, May 1980; in Validation and Assessment of Energy Models, ed. S. Gass, Washington: Department of Commerce, 1981.

PUBLICATIONS cont.:

"Exact Consumer Surplus and Deadweight Loss," working paper 1979, American Economic Review, 71, 1981.

"Appliance Purchase and Usage Adaptation to a Permanent Time of Day Electricity Rate Schedule," with J. Trimble, August 1983; Journal of Econometrics, 1984.

"Evaluating the Costs and Benefits of Appliance Efficiency Standards," with P. Joskow, MIT Energy Lab Working Paper, MIT-EL82005WP; American Economic Review, 72, 1982.

"Information Costs, Competition and Collective Ratemaking in the Motor Carrier Industry," presented at Conference On Consensual Decision Making, American University, August 1982; American University Law Review, 1983.

"An Overview of IFFS," presented at EIA-NBS Conference on Energy Models, August 1982; in Intermediate Future Forecasting System, ed. S. Gass et al., Washington: 1983.

"Choice of Conservation Actions in the AHS," November 1982; in Energy Simulation Models, ed. R. Crow, 1983.

"Patents and R&D: Searching for a Lag Structure," with B. Hall and Z. Griliches, in Actes du Colloque Econometrie de la Recherce, Paris: 1983.

"The Demand for Optional Local Measured Telephone Service," in Adjusting to Regulatory, Pricing and Marketing Realities, East Lansing: 1983.

"Patents and R&D: Is There a Lag?," with B. Hall and Z. Griliches, 1985; International Economic Review, 1986.

"Price Discrimination and Patent Policy," with J. MacKie-Mason, Rand Journal of Economics, 1988.

"Residential End-Use Load Shape Estimation from Whole-House Metered Data," IEEE Transactions on Power Systems, 1988 (with I. Schick, P. Vsoro, and M. Ruane).

"Competition in Telecommunications for Large Users in New York," with H. Ware and T. Tardiff, Telecommunications in a Competitive Environment, 1989.

"Innovation and International Trade Policy," Oxford Review of Economic Policy, 1988 (with J. MacKie-Mason).

"The Evolution of the Central Office Switch Industry," with W. E. Kohlberg, 1987; in ed. S. Bradley and J. Hausman, Future Competition in Telecommunications, 1989.

"Future Competition in Telecommunications," 1987; ed. S. Bradley and J. Hausman, Future Competition in Telecommunications, 1989.

"Joint Ventures, Strategic Alliances and Collaboration in Telecommunications," presented at International Conference on Joint Ventures in Telecommunications, October 1989, Regulation, 1991.

PUBLICATIONS cont.:

"An Ordered Probit Model of Intra-day Securities Trading," with A. Lo and C. MacKinlay, Journal of Financial Economics, 1992.

"A Proposed Method for Analyzing Competition Among Differentiated Products," with G. Leonard and J.D. Zona, Antitrust Law Journal, 60, 1992.

"Global Competition and Telecommunications," in Bradley, et al., ed., Globalization, Technology and Competition, 1993.

"The Bell Operating Companies and AT&T Venture Abroad and British Telecom and Others Come to the US," presented at Harvard Business Conference on International Telecommunications, 1991, in Bradley, et al., ed., Globalization, Technology and Competition, 1993.

"The Effects of the Breakup of AT&T on Telephone Penetration in the US," with T. Tardiff and A. Belinfante, American Economic Review, 1993.

"Competitive Analysis with Differentiated Products," with G. Leonard and D. Zona, Annales, D'Economie et de Statistique, 34, 1994.

"Proliferation of Networks in Telecommunications," ed. D. Alexander and W. Sichel, Networks, Infrastructure, and the New Task for Regulation, University of Michigan Press, forthcoming 1995.

"The Effect of Superstars in the NBA: Economic Value and Policy," with G. Leonard, mimeo May 1994.

"Valuation of New Goods Under Perfect and Imperfect Competition," MIT Working Paper, June, 1994, forthcoming ed. T. Bresnahan and R. Gordon, University of Chicago Press.

"Cellular Telephone: Competition and Regulation," November 1994; ed. W. Read and W. Sapronov, Telecommunications Law, Regulation & Policy, Ablex Publishing, 1995.

"Competition in Long Distance and Equipment Markets: Effects of the MFJ," 1994, Journal of Managerial and Decision Economics, 1995.

"The Cost of Cellular Telephone Regulation," MIT Working Paper, January 1995.

"State Regulation of Cellular Prices," Wireless Communications Forum, Volume III, April 1995.

"Efficient Local Exchange Competition," with T. Tardiff, Antitrust Bulletin, 1995.

"Valuation and Regulation of New Services in Telecommunications," with T. Tardiff, mimeo, July 1995.

"Market Definition Under Price Discrimination," with G. Leonard and C. Vellturo, forthcoming in Antitrust Law Journal, 1995.

"Telecommunications: Building the Infrastructure for Value Creation," presented at the Harvard Business School Conference, November 16, 1995, forthcoming in ed. S. Bradley and R. Nolan, 1995.

JOINT REPORTS, TESTIMONY, AND BOOKS:

"Project Independence: An Economic Analysis," Technology Review, May 1974.

"The FEA's Project Independence Report: Testimony before Joint Economic Committee," U.S. Congress, March 18, 1975.

"The FEA's Project Independence Report: An Analytical Assessment and Evaluation," NSF Report, June 1975.

"Energy Demand in the ERDA Plan," with D. Wood, Energy Laboratory Report, August 1975.

"A Note on Computational Simplifications and Extensions of the Conditional Probit Model," EPRI report on choice models, September 1977.

"Labor Supply Response of Males to a Negative Income Tax," Testimony for U.S. Senate Finance Subcommittee on Public Assistance, November 22, 1978.

"Appliance Choice with Time of Day Pricing," Energy Laboratory Report, January 1980.

"Discrete Choice Models with Uncertain Attributes," Oak Ridge National Laboratories Report, January 1980.

"Individual Savings Behavior," with P. Diamond, Report to the National Commission on Social Security, May 1980.

"Wealth Accumulation and Retirement," with P. Diamond, Report to the Department of Labor, May 1982.
"A Review of IFFS," Report to the Energy Information Agency, February 1982.

"A Model of Heating System and Appliance Choice," with J. Berkovec and J. Rust, Report to the Department of Energy, December 1983.

"Labor Force Behavior of Older Men After Involuntary Job Loss," with L. Paquette, Report to Department of Health and Human Services, December 1985.

"Pollution and Work Days Lost," with D. Wise and B. Ostrow, NBER Working Paper, January 1984; Revised 1985.

"Demand for Interstate Long Distance Telephone Service," with A. Jafee and T. Tardiff, November 1985.

"Competition in the Information Market 1990", August 1990.

"The Welfare Cost to the US Economy of Regulatory Restriction in Telecommunications," January 1995.

"Benefits and Costs of Vertical Integration of Basic and Enhanced Telecommunications Services," April 1995.

"Statement on the Natural Resource Damage Provisions of CERCLA," Testimony before the U.S. Senate Committee on Environment and Public Works, May 11, 1995; Testimony before the U.S. House of Representatives, Transportation & Infrastructure Committee, Water Resources & Environment Subcommittee, July 11, 1995.

"Competition in Cellular Markets," Testimony before the U.S. House of Representatives, Committee on Commerce, October 12, 1995.

JOINT REPORTS, TESTIMONY, AND BOOKS cont.:

"Merger Policy in Declining Demand Industries," Testimony before the U.S. Federal Trade Commission, November 14, 1995.

The Choice and Utilization of Energy Using Durables, ed. J. Hausman, Palo Alto: EPRI, 1981.

Social Experimentation, ed. J. Hausman and D. Wise, Chicago: 1985.

Future Competition in Telecommunications, ed. S. Bradley and J. Hausman, Harvard: 1989.

Contingent Valuation: A Critical Appraisal, ed. J. Hausman, North Holland, 1993.

Globalization, Technology and Competition, ed. S. Bradley, J. Hausman, R. Nolan, Harvard 1993.

Economic Impact of Deregulating U.S. Communications Industries, The WEFA Group, Burlington, MA, February 1995.

EXHIBIT C

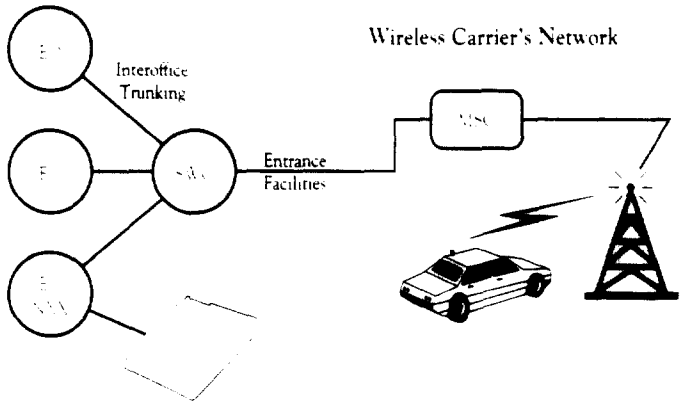
Wireless Interconnection Services: Any Phone, Anywhere, Anytime

PrimeAccess

When it comes to wireless service, Pacific Bell offers a wide spectrum of interconnection arrangements to give you—and your subscribers—reliable access to any phone, anywhere, through your choice of either an analog or digital interface. Call us and we'll help design network enhancements that enable you to provide state-of-the-art wireless services right now—and ensure that you keep pace with new technology in the future.

Type 1 Service. High-Quality Connections.

Wireless Interconnection Type 1

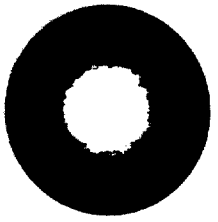


Pacific Bell *Type 1* service is an End Office interconnection that enables your wireless subscribers to place calls to and receive them from any point in the Public Switched Network (PSN). It connects your mobile switching center (MSC) to a Pacific Bell End Office through an analog or digital interface to establish connections with other Pacific Bell End Offices, other carriers and independent companies—and all valid prefixes (NXX codes) within your service area.

Type 1 Interconnection includes access to:

- Operator services, so your subscribers can use a calling card, request alternate billing or get help placing a call
- 411, 611, 911 services (N11 codes)
- 700, 800, 900 and 976 services (service access codes)
- The trunk group's presubscribed long distance company
- Other long distance companies and international carriers

With Pacific Bell *Type 1* wireless interconnection service, there are three trunk configurations to choose from. There's Direct Inward Dial (DID) Trunk, a trunk-side connection between your switch and a Pacific Bell End Office. There's Dial Line Trunk, a line-side connection to our End Office. And there's Trunk Side Message Trunk (TSMT), a trunk



connection from our End Office to your switching terminal. This configuration has a Trunk With Line Treatment feature, which gives you trunk signaling and supervision, but treats the connection as a line for billing purposes.

Direct Inward Dial (DID) Telephone Numbers: *Type 1 Interconnection* gives you blocks of 100 phone numbers to assign to your wireless service subscribers. Pacific Bell uses these numbers to route calls to your control point.

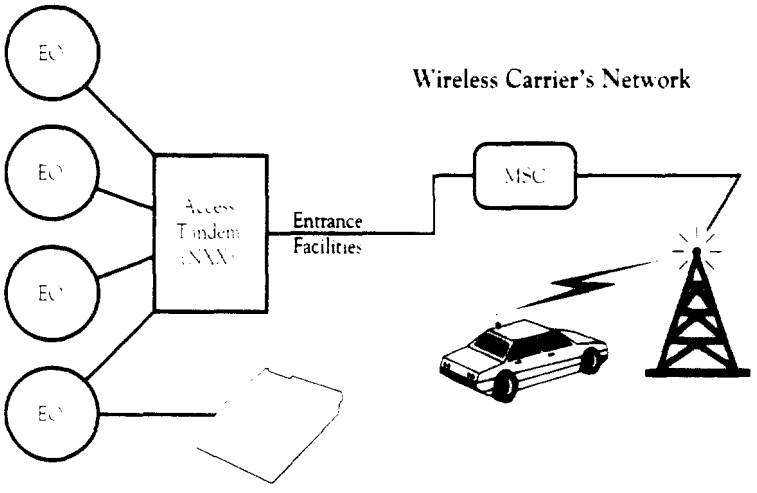
Dedicated NXX Code: You also have the option of having a complete prefix and its associated 10,000 numbers (a dedicated NXX code) designated exclusively to your wireless service company for assignment to your subscribers.

Billing Options: Pacific Bell provides billing for the Land-to-Mobile (L-M) Direction and two options for the Mobile-to-Land (M-L) Direction.

- **L-M:** For all *Type 1* interconnections, we bill the land-line call originator at Pacific Bell local or *Local Plus*℠ rates for completed calls to a mobile prefix, based on conversation minutes.
- **M-L:** For *Type 1* Dial Line Trunk configurations, we bill your wireless service company at Pacific Bell local or *Local Plus* rates for each completed call, based on conversation minutes.
- **M-L:** For *Type 1* TSMT Trunk arrangements, we bill your company a set-up fee for each call completed by your subscribers, plus a special per-minute usage based on the duration of the call.

Type 2A Service. More Flexible Options. A More Efficient Network.

Wireless Interconnection Type 2A



Pacific Bell *Type 2A* service is a digital trunk side interconnection between your mobile switching center (MSC) and a Pacific Bell Access Tandem. This arrangement allows your MSC to connect into the Public Switched Network (PSN) and function like an End Office.

Type 2A is a flexible, cost-effective service that comes with signaling and billing options, so you can choose the ones that best fit your needs.

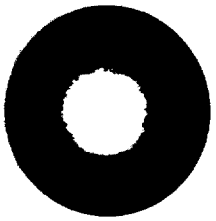
With *Type 2A* service, your subscribers can place calls to and receive them from all valid prefixes (NXX codes) within the service area. They can also use the presubscribed long distance company of their choice for calls from one service area to another.

Dedicated NXX Code: *Type 2A Interconnection* provides you with a complete prefix and its associated 10,000 numbers (dedicated NXX code), allocated exclusively to your company for assignment to your subscribers. Your dedicated NXX code resides in the Access Tandem to which your switch is connected.

The *Type 2A* trunk will deliver calls made to your NXX code that originate on Pacific Bell's switched network or are connected by other local or long distance companies to our switched network.

Mobile-to-Land calls are sent from the *Type 2A Interconnection* to the call termination point via the PSN. All ancillary traffic from your subscribers—operator services, 411, 611, 911, 700, 800, 900 and 976 services—must be forwarded to a separate End Office trunk group, ordered as a *Type 1 Interconnection* service.

Signaling Options: Two signaling options are available with *Type 2* service. There is *Type 2A* in-band Multifrequency (MF) signaling on the individual trunk, and out-of-band



signaling on the SS7 network with *Type 2A7*. Available where technically feasible, *Type 2A7 interconnection* to a tandem is functionally the same as *Type 2A*, with the exception of signaling.

Type 2A7 requires establishing an associated Type S SS7 connection (an "A" Link Pair or "D" Link quad) between your network and the Pacific Bell SS7 network.

Type S Interconnection Service. A Link To Enhanced Service.

Pacific Bell *Type S Interconnection Service* is a physical SS7 signaling link connection between the Pacific Bell network and yours. No SS7-specific applications or services are provided by the *Type S Interconnection* alone. The interface carries signaling information to support the applications and services your company and Pacific Bell provide.

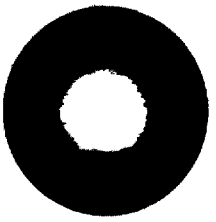
The *Type S* interface is used to support the exchange of:

- Circuit-associated signaling messages, like Integrated Services Digital Network User Part (ISUP) messages, which can support call set up for voice and data calls
- Non-circuit-associated signaling messages, like Transaction Capability Applications Part (TCAP) traffic

Some of the applications between your network and the PSN that can be supported with a Type S interface include IS-41 message transport, call set-up for *Type 2A* traffic, *Call Forwarding*, *Select Call Forwarding*, automatic callback, automatic recall, and other class features. Ask your Pacific Bell Account Team for details about the specific services you can offer your subscribers through the *Type S Interconnection*.

Billing Options: With *Type 2A/2A7* service, you can select the billing arrangement to be assigned to your NXX code, i.e., a blended and an unbundled option. All traffic over a single tandem trunk group in either direction must carry identical billing options. There are three billing options in the Land-to-Mobile (L-M) Direction and two in the Mobile-to-Land (M-L) Direction.

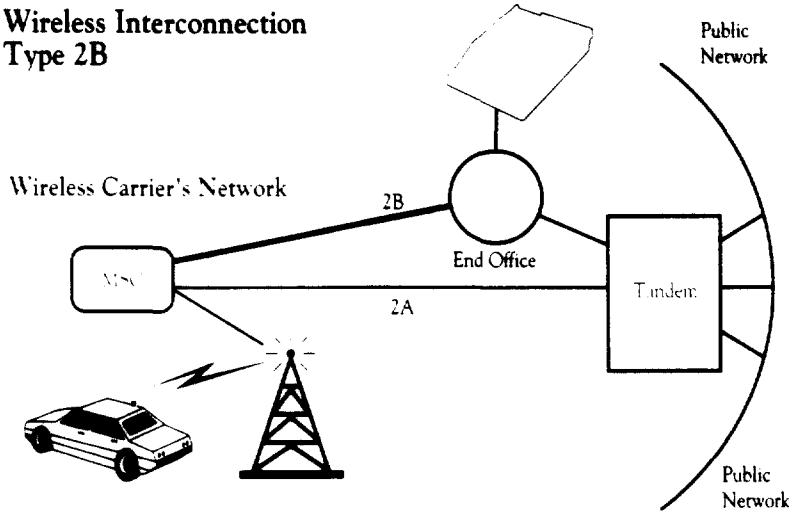
- **LM1:** Your company pays no usage charges. The land-line caller who dialed your subscriber's mobile phone number is billed for the call at Pacific Bell local or *Local Plus*℠ tariffed rates. Call mileage is measured from the land-line caller's Serving Wire Center to the Access Tandem of the NXX code that was dialed. Your company pays for the digital facility and trunk(s). This is an unbundled arrangement.



- ***LM2-B:*** With this blended billing option, your company pays a usage rate that includes the digital facility. We charge you only for calls beyond the local calling area—measured from the land-line caller's End Office to the Serving Wire Center of the tandem where your NXX code resides. Charges for such calls include a setup fee, plus a special per-minute usage rate based on the call's duration. The land-line caller can dial your subscriber's mobile number from anywhere within the service area, and be billed for only a local call. There is a trunk efficiency level requirement for this option, which is available at both Basic and Term pricing.
- ***LM2-U:*** This unbundled usage billing option has the same provisions as *LM2-B*, except that the usage rate paid by your company does not include the digital facility because you are billed separately for it. There is no minimum trunk efficiency level required.
- ***ML1:*** Your company pays separately for the digital facility, trunk(s) and usage with this unbundled option. We bill your company a set up fee for each call completed by your subscribers, plus a special per-minute usage rate based on the call's connect time. You choose the Basic or Term pricing rate.
- ***ML2:*** With this blended usage billing option, your company pays a usage rate that includes a charge for the digital facility, and is billed separately for the trunk(s). We charge you a set up fee for each call completed by your subscribers, plus a special per-minute usage rate based on connect time of the call. There is a trunk efficiency level requirement for this option, which is available at both Basic and Term pricing.

Type 2B Service. Highly Convenient Options. With High-Volume Discounts.

Wireless Interconnection Type 2B



Pacific Bell *Type 2B* service is a one-way Mobile-to-Land digital trunk group connection between your switch and a Pacific Bell End Office switch. It's an ideal arrangement for carriers who have a large volume of calls to phone numbers served by a specific Pacific Bell End Office switching system.

With *Type 2B* service, your subscribers can place calls to land-line telephones served by the End Office to which you are connected. You may order the *Type 2B* connecting trunk group arranged either for high usage traffic to a specific End Office switch or as a "direct final," with no traffic overflow.

When used as a cost-effective supplement to a *Type 2A Interconnection*, the first route for your subscribers' calls is over the *Type 2B*. The second option is to route the calls to your *Type 2A* trunk group. This arrangement provides you with network efficiency for high volume traffic and works as an alternate route for network reliability in case of disaster.

Billing Options: For *Type 2B* service, we bill your company a set up fee for each call completed by your subscribers, plus a special per-minute usage rate based on the connect time of the call. You can choose the Basic or Term pricing rate.

Give your subscribers the benefits of our *PrimeAccess*™ commitment—leading-edge technology, competitive prices and the network expertise of Pacific Bell. For more information, please call a Pacific Bell Industry Market Consultant at **1-800-309-0750**.

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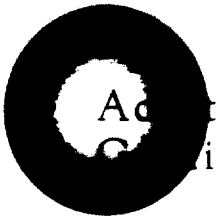


Additional Services: Creating the Competitive Edge

PrimeAccess™

When you link your wireless service company to Pacific Bell, you can select from a host of functional, flexible ancillary services designed to build your subscriber base, differentiate your service and improve your bottom line. Our optional services can:

- Improve your control over calling access
- Simplify your billing procedures
- Increase billable air time

Operator Services: gives your customers access to our operators at a per-call charge, so they can get help placing a call or request alternate billing.

Directory Assistance Services: lets subscribers dial Directory Assistance from their cellular phones to request listed numbers anywhere in their service area. Your subscribers will place more calls from their mobile phones, instead of waiting until they reach a land-based line.

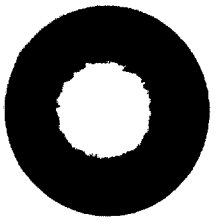
And your subscribers get 24 hour-a-day access to our Directory Assistance databases. They're current, complete and updated five times weekly—and your subscribers can reach them by dialing the same way they do at home and at work.

Cellular Call Completion: offers your subscribers the option of having the Operator automatically complete the call to the number they requested—and offers all of the benefits of standard Directory Assistance Service:

- Saves time and simplifies connection to the retrieved listing
- Eliminates the need to write or memorize numbers, hang up and redial—an invaluable safety feature for drivers traveling on California highways
- Enhances customer relations as our professional operators thank your subscribers on every Directory Assistance call, using your company's name
- Lets Directory Assistance operators complete calls within the service area for multiple area codes

Every convenience encourages network use—and increases billable air time. Cellular Call Completion is offered on a service area-wide basis with statewide accessibility. A *Type 2*AOSS connection is required.

over please



Type 2AOSS Interconnection: brings you direct digital connections to Pacific Bell Directory Assistance, via Operator Services DMS TOPS tandem switches. The 2AOSS arrangement allows the same economical usage rates as the *Type 2A* connection to our Access Tandem. And it gives you a head start on your future.

Bill Screening Options: are available with *Type 1* and *Type 2* service. Billed Number Screening prevents the billing of third party or collect calls to a telephone number assigned to your company in either a dedicated NXX code or DID block of numbers. Selective Class of Call Blocking allows you to block calls from your subscribers—on a line-by-line basis—to 900, 976 and/or long distance numbers.

Billing Services: takes the most time-consuming aspects of billing—and puts them in the experienced and capable hands of Pacific Bell. Your corporate identity is maintained with your company's name, logo and charges appearing on your own separate bill page(s). You can select some or all of our service options:

- Bill processing and rendering of charges on a separate page of a Pacific Bell bill
- Collection and settlement of the total amount due, by Pacific Bell purchasing your company's accounts receivables, discounted by a predetermined uncollectible factor
- Bill messaging and preprinted inserts for relaying information or promoting new products and services—targeted to a specific market, or to Pacific Bell's entire customer base
- Technical support for data processing, media preference, error investigation and resolution, revenue tracking and other features

Customer Services: that Pacific Bell offers end-users on your behalf include collecting account and credit information and determining bill arrangements and areas of service(s) desired. We will also negotiate service with the end-user through a marketing or customer contact group.

Service Assurance: maintains the services that wireless retailers offer their subscribers. This assurance covers reactive maintenance, such as responding to trouble reported by the customer, and proactive maintenance—continuous network monitoring to detect alarms, thresholds, patterns and trends.

Give your subscribers the benefits of our *PrimeAccess*℠ commitment—leading-edge technology, competitive prices and the network expertise of Pacific Bell. For more information, please call a Pacific Bell Industry Market Consultant at **1-800-309-0750**.

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Wireless Interconnection Services Price Sheet: Accessibility Meets Affordability

Pacific Bell brings you wireless accessibility with highly competitive affordability. The prices shown here are current as of June 1995—they are subject to change due to contract or tariff revisions. *Wireless Interconnection Services* are presently offered under contractual arrangement.

PrimeAccess

Wireless Usage Rates

	Basic Rate		Commitment Rate	
	Call Set up	Call Duration	Call Set up	Call Duration
Type 1				
Land-to-Mobile	Call Pays Usage Rates		N/A	N/A
Mobile-to-Land	$ 0.0303	$ 0.0146	N/A	N/A
Type 2B				
Mobile-to-Land*	$ 0.0248	$ 0.0026	$ 0.0230	$ 0.0025
Type 2A				
Unbundled (1)				
Land-to-Mobile	$ 0.0261	$ 0.0073	$ 0.0240	$ 0.0067
Mobile-to-Land*	$ 0.0295	$ 0.0100	$ 0.0270	$ 0.0092
Blended (2)				
Land-to-Mobile	$ 0.0266	$ 0.0073	$ 0.0244	$ 0.0067
Mobile-to-Land*	$ 0.0348	$ 0.0100	$ 0.0319	$ 0.0092
Paging				
Unbundled (1)	$ 0.0112	$ 0.0053	$ 0.0093	$ 0.0044
Blended (2)	$ 0.0129	$ 0.0053	$ 0.0108	$ 0.0044

Notes: (1) Unbundled usage rates do not include the facility or trunks which are ordered and billed separately.

(2) Blended usage rates include the digital facility. Trunks are billed separately.

(3) Call Duration rates are based on completed call conversation minutes unless shown with * which indicates connect minutes.

Wireless Services Rates

Numbers	Non-Recurring	Monthly	Per Order
DID	$ 250.00	$ 0.41 (4)	
Dedicated NXX Codes: (5)			
209	$ 15,700.00	$ 41.00 (6)	
213	$ 29,800.00	$ 41.00 (6)	
310	$ 28,000.00	$ 41.00 (6)	
408	$ 22,600.00	$ 41.00 (6)	
415	$ 22,400.00	$ 41.00 (6)	
510	$ 24,900.00	$ 41.00 (6)	
562	$ 28,000.00	$ 41.00 (6)	
619	$ 15,800.00	$ 41.00 (6)	
707	$ 22,500.00	$ 41.00 (6)	
714	$ 27,600.00	$ 41.00 (6)	
805	$ 25,300.00	$ 41.00 (6)	
818	$ 30,600.00	$ 41.00 (6)	
909	$ 9,400.00	$ 41.00 (6)	
916	$ 15,500.00	$ 41.00 (6)	
Trunks			
Type 1	$ 83.00	$ 34.80 (7)	
Type 2A	$ 97.00		$ 74.00
Type 2B	$ 97.00		$ 74.00
Type 2AOSS	$ 97.00		$ 74.00
Facilities			
DS1			
Channel Termination	$ 633.50	$ 75.00	
Multiplexer	NA	$ 325.00	
Mileage Fixed / Per Mile	NA	$ 125.00 / $ 25.00	
DS3 and SONET			
Rates vary depending upon zone and network configuration and are available on an individual case basis.			

Notes: (4) Each additional 100 number block is $64.00.
(5) Non-recurring charges may be paid in $1,000.00 per month installments.
(6) Applies to Type 1 only.
(7) Includes trunk rate and circuit termination.

Give your subscribers the benefits of our *PrimeAccess*™ commitment—leading-edge technology, competitive prices and the network expertise of Pacific Bell. If you have any questions about these charts, or would like more information, please call a Pacific Bell Industry Market Consultant at 1-800-309-0750.

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EXHIBIT D

INCREMENTAL COST PRINCIPLES FOR LOCAL AND WIRELESS NETWORK INTERCONNECTION

by

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and

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Prepared for Pacific Telesis

March 4, 1996